

REMARKS/ARGUMENTS

Reconsideration of the above application in view of the above amendment and the below remarks is requested. Claims 1 and 2 have been amended to further define the invention.

In the Office Action, the Patent Office rejected claims 1 and 2 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Takano et al (JP 2002-006514). Applicants note that JP 2002-006514 corresponds to United States Patent No. 7195863, which is a related case to the above application.

The Patent Office states that Takano et al teach that adjusting the mixing ratio of acid to base affects the reduction of thickness of the resist. The Patent Office admits that Takano et al do not teach the surfactant being one that is formed at the equivalent ratio of acid to base as found in applicants' claims.

In Takano et al in [0019], (perhaps better taken from United States Patent No. 7195863 at column 5, lines 23 to 33; emphasis added), the ratio of acid and base is discussed as follows:

That is, in the case of using, for example, a positive-working photoresist as the chemically amplified photoresist, it suffices to adjust, upon using a salt between the organic acid and the amine or ammonium as the surfactant, the mixing ratio of the organic acid to the amine or ammonium so that pH of the composition for reducing development defects becomes at an optimal pH within the above-described range ["PH of the composition is preferably 1.5 to 4.5, more preferably 1.7 to 3.5."; column 4, lines 57 and 58]. It has been found that, in this mixing, better results can often be obtained when the organic acid is used in an amount more than the equivalent amount of the base,

Furthermore, Takano et al at [0017] state that "when a chemistry magnification mold photoresist is a positive type, that whose constituent for development defective reduction is acidity is used preferably. As for the acid condition of this constituent, it is desirable that it is pH 1.5-4.5, and it is still more desirable that it is 1.7-3.5."

The present application states that

the amount of film thickness reduction subsequent to a development of a positive-working chemically amplified photoresist can be enlarged when the equivalent of acid and base which constitute the surfactant is made excess of base compared with acid upon a formation of a surfactant which is contained in the composition for preventing development defects, and the amount of film thickness reduction of a photoresist subsequent to a development can be increased or decreased by controlling the amount of the base used at this time, (page 9, middle paragraph, emphasis added)

In order to make the amount of reduction in thickness of photoresist film after developing treatment big in amount, when forming the surfactant described in above items (1) to (4) which is contained in the composition for preventing development-defects, an equivalent quantity of base is made excessive to that of acid in the present invention. (page 12, top of page, emphasis added)

Thus, Takano et al require that there be an excess of acid as opposed to applicants' invention which is for an excess of base.

The Patent Office states that Takano et al show that the film loss in quantity at the time of development is the result effective variable [0019] and that it is then optimizable. However, contrary to the view by the Patent Office, the skilled artisan would not optimize the ratio of acid to base as taught by Takano et al to match that of applicants' invention since Takano et al teach in [0019] that the with a positive photoresist, the ratio of an organic acid:base, in mole ratio, is usually from 7:0 to about 7:6, it is desirable 7:4 - 7:6 and

more preferably 7:5.¹ The aforementioned ratios in Takano et al show an excess of acid to base, the opposite of applicants' invention. Takano et al also do not teach or suggest that amount of film thickness reduction of a photoresist subsequent to a development can be increased or decreased by controlling the amount of the base used.

This means that Takano et al only recognize an optimization of the ratio to acid to base as disclosed in therein. Takano et al fail to teach ratios beyond what they have disclosed and provide no basis or guidance as to what would happen if the ratio of acid to base was outside the ratios disclosed in Takano et al. the Patent Office is hypothesizing what might happen in Takano et al without any basis found therein. The only basis that the Patent Office can point to is applicants' specification, which is not permitted.

The Patent Office has the burden of showing that having an acid:base ratio where the amount of acid is greater than base (which is Takano et al) can be optimized by a skilled artisan to one where the acid:base ratio is where the amount of base is greater than acid (applicants' invention) and that the skilled artisan would know to do this based on the teaching of Takano et al.

Takano et al do not teach a skilled artisan to go beyond the acid:base ratios listed therein. Takano et al state that "... when a chemistry magnification mold photoresist is a positive type, that whose constituent for development defective reduction is acidity is used preferably. As for the acid condition of this constituent, it is desirable that it is pH 1.5-4.5,

¹ see also United States Patent No. 7195863 at column 5, lines 41 to 46 (emphasis added) - " In the composition for reducing development defects to be applied to a positive-working chemically amplified photoresist, the ratio of the organic acid to the base (for example, amine) is usually about 7:0-7:6 in molar ratio, preferably about 7:4-7:6, more preferably about 7:5. "

and it is still more desirable that it is 1.7-3.5." (see [0017] of Takano et al (emphasis added))².

Takano et al also state that there are other ways to optimize reduction in film thickness. See Takano et al at generally at [0022] to [0024] (see United States Patent No. 7195863 at column 6, lines 26 to 51 (emphasis added):

Additionally, in order to improve coating properties, a water-soluble organic solvent may be used together with water. ...

In addition, optimization of reduction in thickness of resist coating in the present invention may also be attained by properly adjusting baking time or baking temperature of the resist and the composition for reducing development defects as well as optimization by the composition itself for reducing development defects.

The Patent Office has not shown that the ratio of acid:base in Takano et al is a result effective variable since the ratio of acid:base in the present application (amount of base is greater than amount of acid) is outside the acid:base ratio disclosed by Takano et al (amount of acid is greater than amount of base) and that there are other factors that are result effective variables. There is no demonstration in Takano et al that varying the acid:base ratio has an effect on defects, especially when acid:base ratio of Takano et al is exceeded.

Thus, the ratio of acid:base in Takano et al is not the only way to optimize the reduction in film thickness and that it is not the only result effective variable. The Patent Office has not met its burden of establishing that Takano et al recognized acid:base ratio

² see also United States Patent No. 7195863 at column 4, lines 55-58 (emphasis added) " ... when the chemically amplified photoresist is positive-working, the composition for reducing development defects is preferably acidic. PH of the composition is preferably 1.5 to 4.5, more preferably 1.7 to 3.5."

as the only variable that is result effective, especially since applicants have distinguished their acid:base ratio over that which is disclosed by Takano et al. As stated by applicants in their specification:

In addition, in the publication [Japanese Unexamined Patent Publication No. 2002-6514], there is no description that a film thickness reduction can be controlled quantitatively. Because of this there is a problem that it is difficult to obtain the composition for reducing development-defects which can provide an optimal film thickness reduction in order to make the pattern-profiler rectangular and good. (top of page 8, emphasis added).

The Patent Office has skipped over its burden to establish an evidentiary foundation for the *prima facie* case of obviousness. In particular, the Patent Office has not supported its assertion that changing the acid:base ratio as claimed by applicants is a known result-effective variable that would have been obvious to optimize. Establishing such a foundation is particularly important when since applicants have distinguished their acid:base ratio from that of Takano et al as shown above.

In addition, applicants' Examples show that compositions having an acid:base ratio where the amount of base is greater than the amount of acid have better performance than compositions where the acid:base ratio has an amount of acid greater than the amount of base (see pages 20 to 22 of applicants' specification). The burden is on the Patent Office to establish an adequate basis to question the adequacy of applicants' disclosure. Assertions in a disclosure must be met with evidence, not by mere counter-assertion or argument. The Patent Office has not provided any evidence.

Given the teaching of Takano et al, there is no basis for a skilled artisan to go beyond the pH limits of Takano et al (1.5 to 4.5 - thus, an acidic medium) since Takano et al teach that the better results are obtained when the amount of organic acid is greater than the amount of the base. A skilled artisan would realize that based on the teaching of

Takano et al, going to a system where the amount of base exceeds the amount of acid would not provide good results. The Patent Office has not shown that Takano et al teach or suggest a system that when the amount of base is greater than the amount of acid (applicants' invention), better results are obtained where a system discloses that the amount of acid exceeds the amount of base (Takano et al). In taking such a view, the Patent Office is engaging in an invitation to experiment. Takano et al do not contain a sufficient teaching of how to obtain the desired result embodied by applicants' claims, or that the claimed result embodied by applicants' claims would be obtained if certain directions were pursued.

All the Patent Office has done is stated that the mixing ratio is the result effective variable and would then be optimizable. In reality, the Patent Office is suggesting the possibility that a skilled artisan might want to change the acid:base ratio taught by Takano et al to that which is claimed by applicants. However, that Takano et al could be modified to change the acid:base ratio from an amount of acid greater than the amount of base to an acid:base ratio where the amount of base is greater than the amount of acid, which is applicants' invention, cannot be made unless Takano et al suggest such a desired modification. No such desired modifications are not taught or suggested by Takano et al and the Patent Office has not provided any foundation for such.

The Patent Office has pointed to no passage in Takano et al which suggests or teaches increasing the amount of base so that it exceeds the amount of acid as applicants have claimed. Since there is no cited passage by the Patent Office, it can only be presumed that the Patent Office's obviousness conclusion is based on impermissible hindsight.

Applicants' claimed acid:base ratio is far outside the corresponding acid:base ratio of Takano et al. It is well settled that the discovery of optimum values, which are far

outside the prior art values and not in anyway suggested by the prior art as here, likely would not have been obvious. Stated another way, it is generally not a matter of obviousness for one of ordinary skill in the art to optimize a result effective variable outside the range disclosed in the prior art. When determining whether the claimed invention is obvious, a prior art document must be read as a whole and consideration must be given where the document teaches away from the claimed invention, which is the present case.

Coming to the conclusion that Takano et al teach or suggest applicants' acid:base ratio requires bridging several gaps in the path to the conclusion. Bridging those gaps requires knowledge of applicants' solution. The Patent Office states that Takano teaches that adjusting the mixing ratio of the acid to base affects the reduction of thickness of the resist (Office Action, page 3). While the statement linking acid:base ratio to reduction of thickness might lead one of ordinary skill in the art down the path of investigation, it does not directly teach how to obtain the desired reduction of film thickness achieved by applicants' acid:base ratio or indicate that the desired reduction of film thickness would be obtained if the acid:base ratio went from higher acid/low base to higher base/lower acid. The general disclosure must do more than lead one of ordinary skill in the art down the path of investigation, it must contain a sufficient teaching of how to obtain the desired result or must indicate that the claimed result would be obtained if certain directions were pursued. No such teaching exists in Takano et al and the Patent Office has not pointed to any passage in Takano et al to support its view.

Applicants' acid:base ratio is a difference in kind, not a difference in degree. Here, applicants' new acid:base ratio (where the amount of base is greater than the amount of acid) produces highly beneficial results:

" ... the amount of film thickness reduction subsequent to a development of a positive-working chemically amplified photoresist can be enlarged when the equivalent of acid and base which constitute the surfactant is made excess of base compared with acid upon a formation of a surfactant which is contained in the composition for preventing development defects, and the amount of film thickness reduction of a photoresist subsequent to a development can be increased or decreased by controlling the amount of the base used at this time ..." (see page 9 of applicants' application).

Such results are not predicted by Takano et al.

It would not have been obvious for one of ordinary skill in the art to find an optimum value that is far outside the range taught by the prior art. Since materials act differently at different pH levels, a skilled artisan having common sense would not find direction from Takano et al to go beyond the acid - base ratios taught therein because of the results achieved by Takano et al.

As for the Patent Office's statement in the Office Action on page 5 that the feature that applicant relies on (pH) is not recited in the claims, it is pointed out that the reference to "equivalent ratio of acid to base of 1:1.04 – 1:3" would necessarily inform a person having ordinary skill in the art that the pH would be basic. In addition, applicants also point out that Takano et al disclose ratios of acid to base where the amount of acid exceeds the amount of base. See column 5, lines 41 to 46 of United States Patent No. 7195863 (see footnote 1 on page 7).

Furthermore, Takano et al specifically state that

The composition for reducing development defects to be used in the present invention preferably contains a surfactant and, when the chemically amplified photoresist is positive-working, the composition for reducing development defects is preferably acidic. (see column 4, lines 53 to 57)

as well as

It has been found that, in this mixing, better results can often be obtained when the organic acid is used in an amount more than the equivalent amount of the base ... (see column 5, lines 30 to 33)

Thus, Takano et al fail to demonstrate how a person having ordinary skill in the art would go beyond the pH/acid:base ratio of Takano et al. Takano et al fail to show applicants' equivalent ratio of acid to base of 1:1.04 - 1:3 as claimed.

Regarding paragraph 9 on page 6 of the Office Action, it is noted that in the case cited by the Patent Office, the claimed subject matter, 0.3% Mo and 0.8% Ni, was found to be between alloys in the prior art, 0.25% Mo and 0.75% Ni and 0.31% Mo and 0.94% Ni. This is not the case in the present application since Takano et al teach up to a specific range of pH or ratio of acid to base for positive resists and applicants have shown that the properties of their invention are different. The Patent Office is invited to provide factual evidence or scientific reasoning to support its statement that the acid:base ratio of Takano et al, for example, 7:4 - 7:6 (see column 5, line 45) which converts to 1.75:1 - 1.167:1, is so close to applicants' claimed range of 1:1.04 - 1:3.

Regarding paragraph 10 on pages 6 and 7 of the Office Action, the Patent Office states that Takano does teach that such mixing would be apparent or else the addition of more acid to base would not have been noted as being preferred to adding just acid and base, citing [0020] of Takano. Applicants believe that the Patent Office meant to identify [0019] of Takano as [0020] of Takano does not discuss acid and base ratios. [0020] from Takano is as follows (taken from the machine language translation of JP 2002-006514 at the Japanese Patent Office):

[0020]Water soluble resin and various additive agents can be blended with a constituent for developing defect reduction of this invention in the range which does not spoil performance if needed. As water soluble resin used for a constituent for developing defect reduction of this invention, For example, poly (vinyl alcohol), poly (acrylic acid), poly (vinyl pyrrolidone), Poly (alpha-trifluoro methylacrylic acid), poly (vinylmethyl ether -**- maleic anhydride), Poly (ethylene glycol -**- propylene glycol), poly (N-vinyl-pyrrolidone -**- vinyl acetate), Poly (N-vinyl-pyrrolidone -**- vinyl alcohol), poly (N-vinyl-pyrrolidone Koa krill acid), Poly (N-vinyl-pyrrolidone Koa krill acid methyl), poly (N-vinyl-pyrrolidone -**- methacrylic acid), Poly (N-vinyl-pyrrolidone -**- methyl methacrylate), poly (N-vinyl-pyrrolidone coma lane acid), Poly (N-vinyl-pyrrolidone coma lane acid dimethyl), poly (N-vinyl-pyrrolidone -**- maleic anhydride), They are raised by poly (N-vinyl-pyrrolidone -**- itaconic acid), poly (N-vinyl-pyrrolidone -**- itaconic acid methyl), poly (N-vinyl-pyrrolidone -**- itaconic acid anhydride), fluorination polyether, etc., and Poly (acrylic acid), poly (vinyl pyrrolidone), Fluorination polyether etc. are especially preferred.

Paragraph [0019] in Takano et al (JP 2002-006514) corresponds to column 5, lines 15 to 48 of United States Patent No. 7195863:

These surfactants are used as a 0.1 wt % 25 wt %, more preferably 2 wt % 4 wt % aqueous solution for the composition for reducing development defects. In this situation, it is preferred to optimize the amount of reduction in thickness of the resist layer by properly adjusting the mixing ratio of the organic acid to the base such as amine or ammonia or adjusting basicity of the composition in consideration of the kind of a chemically amplified photoresist to be used or processing conditions. That is, in the case of using, for example, a positive-working photoresist as the chemically amplified photoresist, it suffices to adjust, upon using a salt between the organic acid and the amine or ammonium as the surfactant, the mixing ratio of the organic acid to the amine or ammonium so that pH of the composition for reducing development defects becomes at an optimal pH within the above-described range.^{**} It has been found that, in this mixing, better results can often be obtained when the organic acid is used in an amount more than the equivalent amount of the base, than when the surfactant is wholly composed of the organic acid or the salt between the organic acid and the amine or ammonium. Thus, optimal results can be obtained by adjusting the amount of reduction in thickness of resist coating upon development through adjustment of the mixing ratio of the organic acid to the base such as amine or ammonia to thereby properly adjust pH depending upon kind of the chemically amplified photoresist to be used or processing conditions. In the composition for reducing development defects to be applied to a positive-working

chemically amplified photoresist, the ratio of the organic acid to the base (for example, amine) is usually about 7:0-7:6 in molar ratio, preferably about 7:4-7:6, more preferably about 7:5. In terms of organic acid: salt, the molar ratio is usually about 7:0-1:6, preferably about 3:4-1:6, more preferably about 2:5.

There is no basis for the Patent Office's statement in paragraph 10 of the Office Action. See the underlined portions from Takano et al (United States Patent No. 7195863). For the positive resists in Takano et al, they indicate that the ratio of acid to base is 7:0-7:6, completely the opposite of applicants' ratio.

The above-described range (see ** in above) is found at column 4, lines 57 to 61: "PH of the composition is preferably 1.5 to 4.5, more preferably 1.7 to 3.5. In addition, when the chemically amplified photoresist is negative-working, the composition is preferably weakly acidic to alkaline." Although Takano et al mention weakly acidic or alkaline, that is for negative photoresists. Applicants' claims are to positive photoresists as is Takano et al's discussion relating to an acid:base ratio where the amount of acid is greater than the amount of base.

The statement in paragraph 11 of the Office Action relating to the cited case, *In re McLaughlin*, involved the combination of two different documents. In the present case, the Patent Office has only cited one document and the Patent Office has not shown knowledge within the level of ordinary skill that involves going from an acid:base ratio where the amount of acid is greater than the amount of base (Takano et al) to an acid:base ratio where the amount of acid is less than the amount of base (applicants' invention). The only manner in which the Patent Office could have found such knowledge is from applicants' disclosure, which is not permitted. The Patent Office has still not identified where in Takano et al such knowledge is found. Takano et al reveal no connection in preventing development defects in positive resists when using an equivalent acid:base ratio of 1:1.04 - 1:3 and the Patent Office can only base its view on

hindsight taken from applicants' disclosure. This is even clearer since the Patent Office has admitted that Takano et al do not teach the surfactant being one that is formed at the equivalent ratio of acid to base as found in applicants' claims.

Also in support of applicants' position, enclosed is a Declaration under 37 C.F.R. § 1.132 of Yasushi Akiyama, a named inventor of the present application. In the Declaration, Mr. Akiyama demonstrates that the present invention has unexpected results over Takano et al.

It is shown that for Takano et al, the equivalent (mole) ratio of base (for example, monoethanolamine (MEA)) has to be lower than that of acid to increase the film loss of photoresist film (see Graphs-2 and 3 in the Declaration). The data in Tables-2 and 3 in the Declaration also show that when the equivalent (mole) ratio of base is lower than that of acid, poor pattern profile (T-Top) occurs.

In contrast, for present invention, when TMAH is used as base, the equivalent (mole) ratio of base to acid has to be higher to increase the film loss as shown in the Graph-1 in the Declaration. Also, the data in Table-1 show perfect or virtually perfect pattern profile (rectangular or almost rectangular).

Such results are unexpected.

As such, the rejection over Takano et al is traversed and withdrawal thereof is requested.

Applicants submit that the concerns of the Patent Office have been addressed. Withdrawal of the rejections and issuance of a Notice of Allowance is respectfully solicited.

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Respectfully submitted,

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